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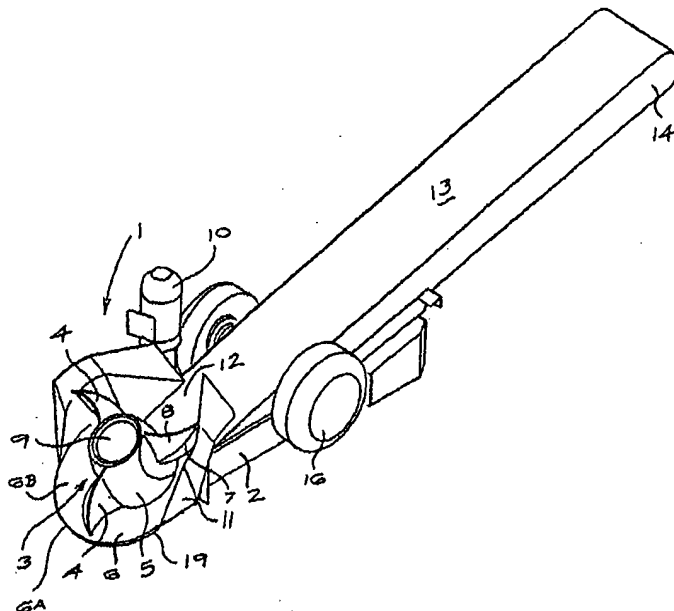
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(54) Title: SCOOP WHEEL EXCAVATOR



(57) Abstract: The invention concerns a method and means for moving particulate material which are particularly suitable for moving rock in underground mining operations and includes a scoop having at least one blade rotatable over a base plate with the axis of the scoop forwardly inclined so that the particulate material can be dug out and lifted to an elevated discharge point for loading further conveying means by gravity.

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SCOOP WHEEL EXCAVATOR**FIELD OF THE INVENTION**

10 This invention relates to a method and means for moving particulate material from one level to a higher level so the material can be fed continuously onto a conveying system.

BACKGROUND TO THE INVENTION

15 The transporting of particulate material from dumps and mine workings has long proved difficult and costly. The moving of rock from underground mine workings has been especially difficult. The equipment available to move this rock has been either inefficient or, where a reasonable performance was achieved, the equipment had high capital and maintenance costs.

20

The equipment known to the applicant which has been used has involved different kinds of operation. The "gathering arm" loader is a massive machine and not suited to hard rock mining conditions because of wear. This wear is prevalent in mine tunneling operations.

25

The "swing through loader" was developed in South Africa to facilitate mine tunneling operations and achieved some success but has not been accepted because of its complexity. The "front end loader" is also used in mining operations, again with limited success. This is because it can be used only under
30 certain mining conditions where there is available adequate working space. It also requires skilled operators and back-up service.

OBJECT OF THE INVENTION

It is an object of this invention to provide a rock loading method and equipment therefor which is suitable for use in mine workings and other loading operations
5 and is economically viable.

SUMMARY OF THE INVENTION

10 In accordance with this invention there is provided a method of moving particulate material characterized in that the material is scooped from one level rotationally about an operatively forwardly inclined axis up a dished inclined surface for discharge at a higher level for further transportation and advancing the inclined surface into the particulate material.

15 Further features of this invention provide for discharging the material onto a second dished inclined surface and similarly rotationally scooping the material in the opposite direction for discharge onto further conveying means at yet higher level.

20 This invention also provides equipment for effecting the above method comprising a rotatable scoop characterized in that the scoop is mounted on an operatively forwardly inclined axis above a dished inclined surface, the surface having a leading edge for engaging into a pile of particulate material and carried on a movable support, the scoop including at least one blade the lower edge of
25 which is movable over the surface.

Further features of the invention provide for there to be a plurality of blades angularly spaced apart around a common hub, for the hub to be rotated by a hydraulic motor, for the surface to be provided by a hard steel plate, for the
30 surface to have a forwardly projecting wear lip and for the blade or blades to be flexibly and removably mounted on the hub.

Still further features of the invention provide for the path of the blades to extend forwardly of the lip plates to permit free penetration of the blades into the rock pile.

5

Still further features of the invention provide for the movable support to be mounted on skids, tracks or wheels, for a piston and cylinder assembly to be connected for moving the support in a stepwise manner and for the surface to include peripheral guides to control the movement of particulate material over the surface.

10

Still further features of the invention provide for a movable support which can continuously move into the rock pile to allow a regular flow of material.

15

Still further features of the invention provide for there to be a pair of scoop assemblies mounted in tandem on the base plate with the assemblies overlapping and the scoops rotatable in opposite directions, for the second scoop assembly to discharge onto a belt conveyor and for the support to carry a hydraulic power pack for the scoop hydraulic motor and the piston and cylinder assembly.

20

Still further features of the invention provide for a multiple scoop wheel arrangement in side-by-side relationship, which would increase the operating width and production of the equipment.

25

Still further features of the invention provide for a hydraulic, electrical, mechanical or hydro powered energy source for the operating mechanism of the excavator.

30

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of this invention will become apparent from the following description of preferred equipment described below with reference to the accompanying drawings.

5 In the drawings:

FIG.1 is a diagrammatic oblique view of one arrangement of the equipment;

10 FIG .2 is a view showing an alternative lip plate assembly;

FIGS.3 & 4 show alternative drive assemblies for the equipment;

15 FIGS.5 & 6 show respectively a pair of scoops in tandem and side by side relationship.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figs 1 and 2 the excavator (1) is designed for operation in confined
20 areas of underground mining operations and especially where broken rock is to be transported from a working face.

The excavator (1) consists essentially of a mobile frame (2) the forward end of which supports a rotatable scoop (3). The scoop (3) has a plurality of blades (4)
25 secured to a central hub (5).

The axis of the hub (5) is inclined forwardly in the direction of operation of the excavator. The angle of inclination will be chosen to meet particular applications.

30 The scoop (3) is mounted above a dished base plate (6) terminating at the front end in a surface engaging digging lip (6a). This lip will be of hardened material.

The dished plate (6) has a part (6c), shown in Fig 5, over which the hub (5) is mounted parallel to the bottom of the hub (5) and an annular outer part (6b) is inclined upwardly so that the loading part of the plate (6), in use, will lie on the surface on which the excavator (1) operates. These features of the base plate can be more clearly seen from the cross sectional view in Fig 5.

The bottom edge (4a) of the blades (4) are shaped to move across the inclined annular part (6b) to move particulate material rearwardly and upwardly. This construction can also be more clearly seen from Fig 5.

The scoop (3) illustrated in Figs 1 and 2 has three blades (4). Each of the blades has a lower section (7) substantially at right angles to the plane of the lower edges of the blades (4) and an upper section (8) which is tilted forwardly in the direction of travel of the blades (4). The blades (4) are removably mounted on the hub (5) and preferably with a limited amount of resilience between the blades and hub.

The hub (5) may be driven to rotate over the surface of the base plate (6) in any convenient manner depending on the power source available. For underground mining a hydraulic motor drive (9) powered from a power pack (10) can be satisfactorily used. The power pack can also be used to drive the excavator as well as its ancillary equipment.

The rear part of the base plate (6) has upwardly directed guides (11) which extend to the scoop discharge area (12) at the uppermost region of the dished base plate (6).

The mobile frame (2) also supports an upwardly inclined belt conveyor (13). The discharge end (14) of conveyor (13) may discharge onto a further inclined

conveyor if necessary to lift excavated rock onto means for transport from the loading area.

5 The support frame (2) can carry retractable anchor posts (15), Fig 5, which may operate either laterally or vertically depending on the working conditions of the excavator (1). In such an arrangement the base plate (6) and scoop (3) will be movable relative to the frame (2) so that the scoop (3) can be advanced into the rock pile to be excavated. For this purpose a hydraulic piston and cylinder assembly (not shown) will be mounted between the base plate (6) and frame (2)
10 so that the lip (6a) can be moved into the rock pile as the scoop (3) removes rock from the pile.

Alternatively the scoop (3) may be rigidly mounted on the frame (2) which in turn may be supported on driven wheels (16) or tracks (17) or an eccentric drive (18)
15 illustrated in Figs 1, 3 and 4 respectively.

It will be appreciated that the eccentric drive may also be used between the base plate (6) and frame (2) to give added digging power to the base plate (6).

20 In use where large rock pieces are to be excavated the rounded front edge (19) to the base plate (6) as shown in Fig 1 has proved the most satisfactory as the force required for its penetration into a rock pile with rotation of the scoops (3) is less than that for the wide straight digging edge (20) illustrated in Fig 2.

25 The forward inclination of the hub axis and dished base plate (6) not only facilitates the action of the scoops to excavate from the rock pile but also lifts the excavated rock to enable it to be discharged by gravity onto further conveying means.

The wide straight lip (20) to the plate (6) shown in Fig 2 has proven successful for excavation of rock piles of small particle size. In these circumstances more blades (4) can be usefully mounted on the hub.

- 5 The invention includes within its scope other embodiments than that above described.

Referring to Fig 5 the excavator (1) shows a pair of scoops (21) and (22) mounted in tandem overlapping relationship with the scoop (22) arranged to
10 receive the discharge from the lower scoop (21). In this way a greater height for the delivery point from the excavator onto the conveyor can be obtained.

In use the scoops (21) and (22) will be driven to rotate in opposite directions to maintain a balanced operation in the movement of the load.

15

Fig 6 illustrates a pair of scoops (23) and (24) working in a side by side relationship on a single base plate (25). This arrangement is suitable for use in conditions where a wide working face of the rock pile to be moved is available.

- 20 The scoops (23) and (24) are in this embodiment also designed to rotate in opposite directions and where the rock pile contains small rock pieces the rotating scoops will dig into the pile and less power will be needed to move the excavator over the surface supporting the rock pile. The scoops (23) and (24) could also be designed to rotate in overlapping relationship.

25

If required each scoop can be duplicated in tandem so that the equipment can deliver from a wide face to a high discharge level.

- 30 It will be appreciated to those skilled in the art that the scoop assembly on its forwardly inclined axis as a basic unit facilitates the design of excavators suitable for a wide range of particular applications.

It will also be appreciated that there are various constructions and configurations of the dished base plate which together with a suitable scoop will fall within the scope of the invention. For example, the dished base plate could be formed by
5 flat surfaces which are inclined in relation to each other and secured together or it could be formed by a bowl with radiused sides.

The apparatus can be adapted for use in gulleys and guided by side walls and may be articulated to facilitate its use in tunnels, stopes or the like. It also can be part of a multiple purpose machine, which might include a drilling apparatus or
10 mining mechanism like road header or the like because of its compact design. It will also preferably be of modular construction to assist in transport, assembly, maintenance and repair.

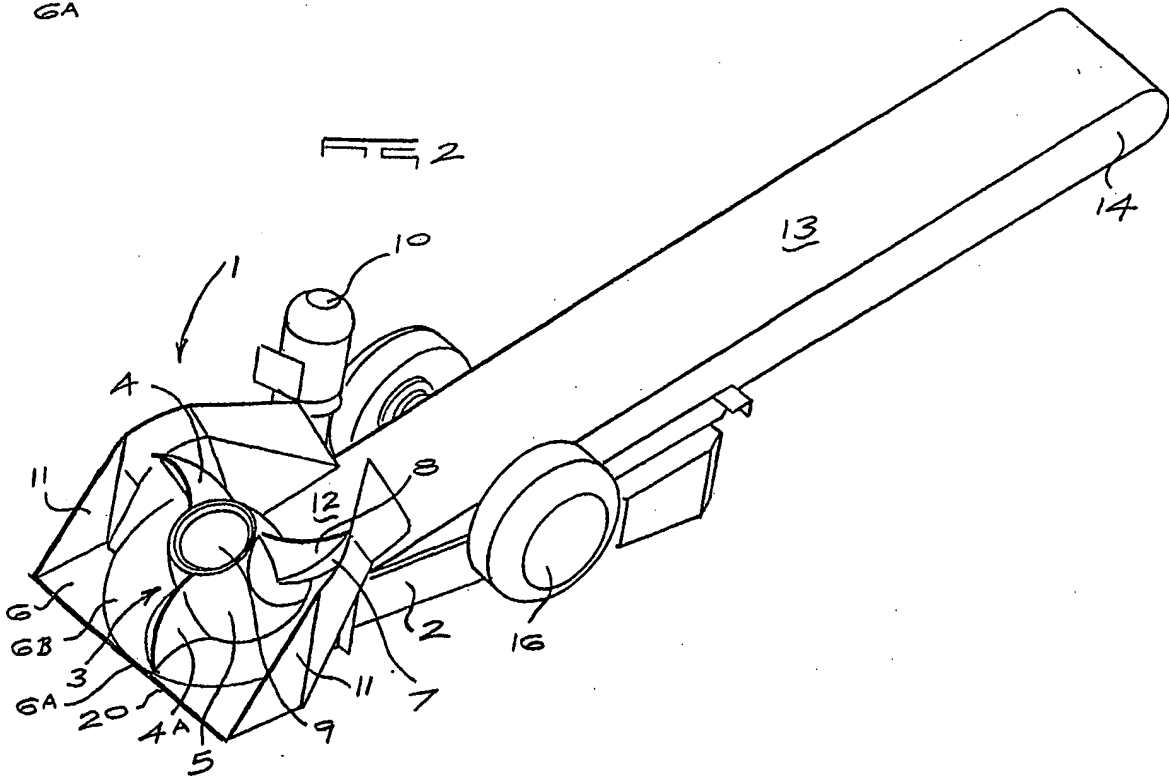
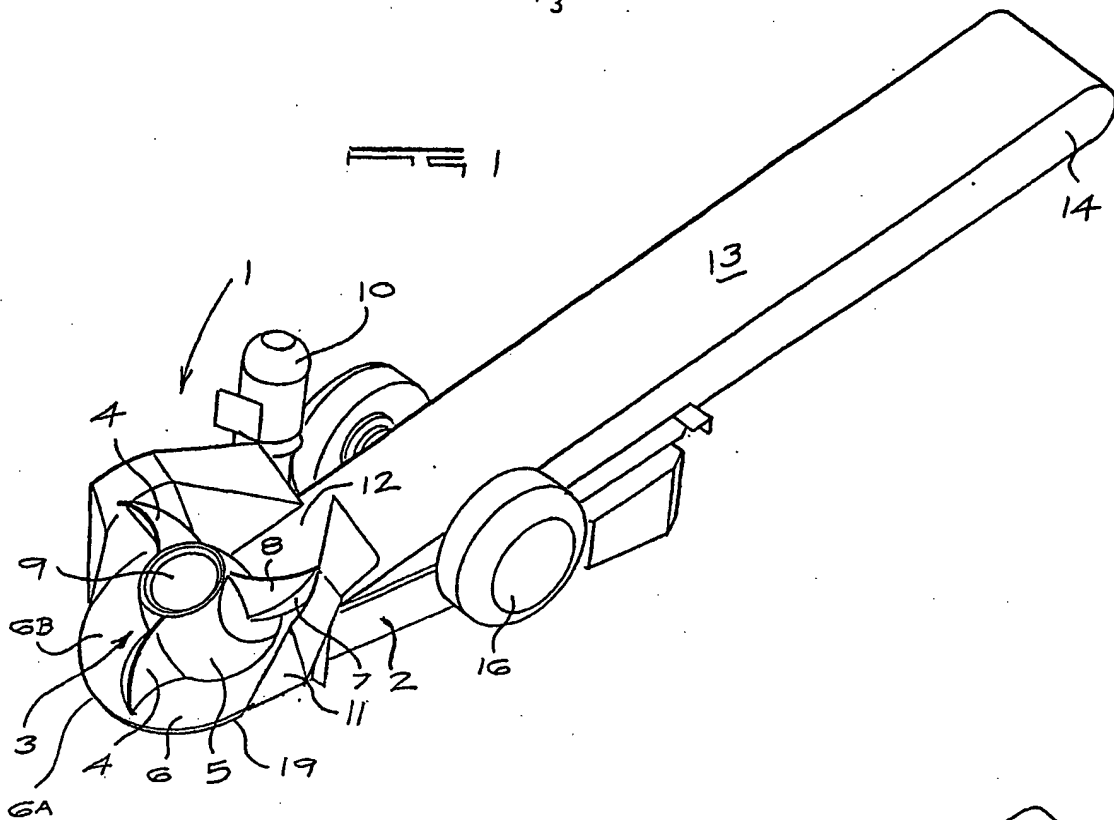
CLAIMS

1. A method of moving particulate material characterized in that the material is scooped from one level rotationally about an operatively forwardly inclined axis up a dished inclined surface for discharge at a higher level for further transportation and advancing the inclined surface into the particulate material.
2. A method of moving particulate material as claimed in claim 1 characterised in that the material is discharged onto a second inclined surface and similarly rotationally scooped in the opposite rotational direction for discharge onto further conveying means at a yet higher level.
3. A method of moving particulate material as claimed in claim 1 characterised in that the material is scooped in two oppositely directed rotational movements up a single inclined surface.
4. Equipment for moving particulate material comprising a rotatable scoop characterized in that the scoop is mounted on an operatively forwardly inclined axis above a dished inclined surface, the surface having a leading edge for engaging into a pile of particulate material and carried on a movable support and the scoop including at least one blade the lower edge of which is movable over the surface.
5. Equipment as claimed in claim 4 wherein the scoop includes a plurality of blades angularly spaced apart around a common hub.

6. Equipment as claimed in claim 4 or 5 wherein the inclined surface is provided by a hard steel base plate having a forwardly projecting wear lip.
- 5 7. Equipment as claimed in any one of claims 4 to 6 wherein the scoop blade or blades are flexibly and removably mounted on the hub.
- 10 8. Equipment as claimed in any one of claims 4 to 7 wherein the movable support is a mobile supporting frame.
9. Equipment as claimed in claim 8 wherein the supporting frame is mounted on skids, wheels or tracks.
- 15 10. Equipment as claimed in claim 8 or 9 wherein the frame is movable in stepwise manner by a piston and cylinder assembly attached at one end to the frame and the other to a releasable anchor.
- 20 11. Equipment as claimed in any one of claims 4 to 10 wherein the inclined surface includes peripheral guides.
12. Equipment as claimed in any of claims 4 to 11 wherein a pair of scoops are mounted in side by side relationship.
- 25 13. Equipment as claimed in any one of claims 4 to 11 wherein a pair of scoops are mounted in tandem.
- 30 14. Equipment as claimed in claim 12 or 13 wherein the scoops are mounted for overlapping rotation in opposite directions on the base plate.

15. Equipment as claimed in any one of claims 6 to 14 wherein the wear lip is located behind the operatively forward end of the scoop path.
- 5 16. Equipment as claimed in any one of claims to 6 to 14 wherein the wear lip is curved and follows the operatively forward part of the scoop path.
- 10 17. Equipment as claimed in any one of claims 4 to 16 powered from a hydraulic or electrical or mechanical or hydropower source.
- 15 18. Equipment for moving particulate material substantially as described with reference to any one of the figures in the accompanying drawings.
- 20 19. A method of moving particulate material substantially as described with reference to any one of the figures in the accompanying drawings.

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FIG 4

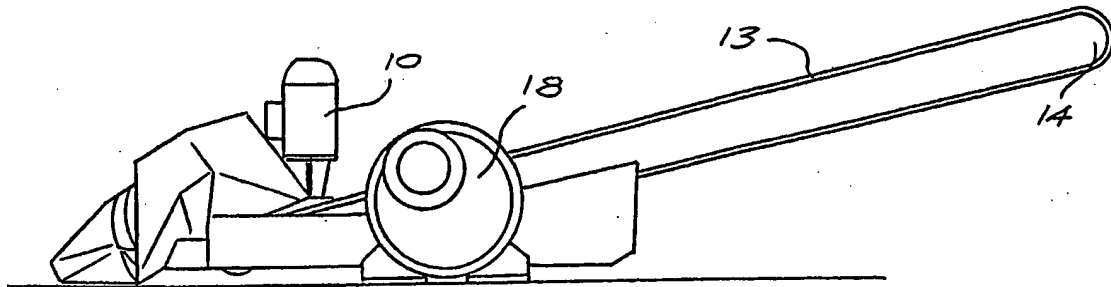
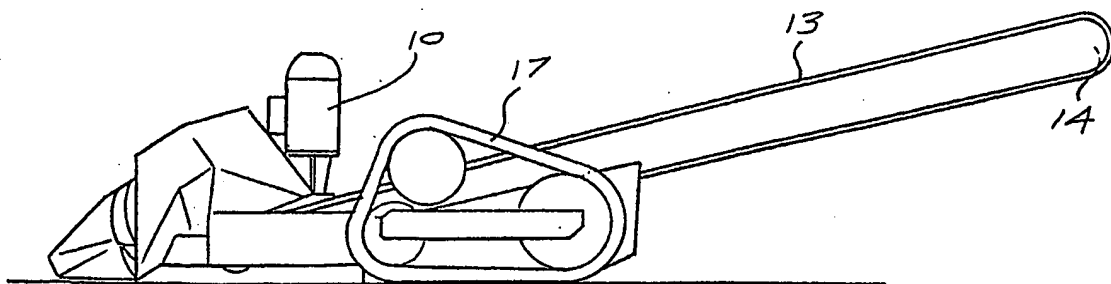


FIG 3



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FIG 5

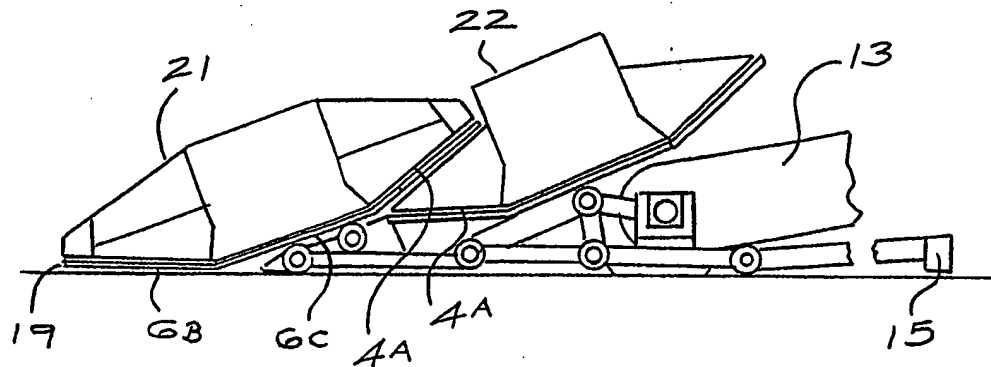
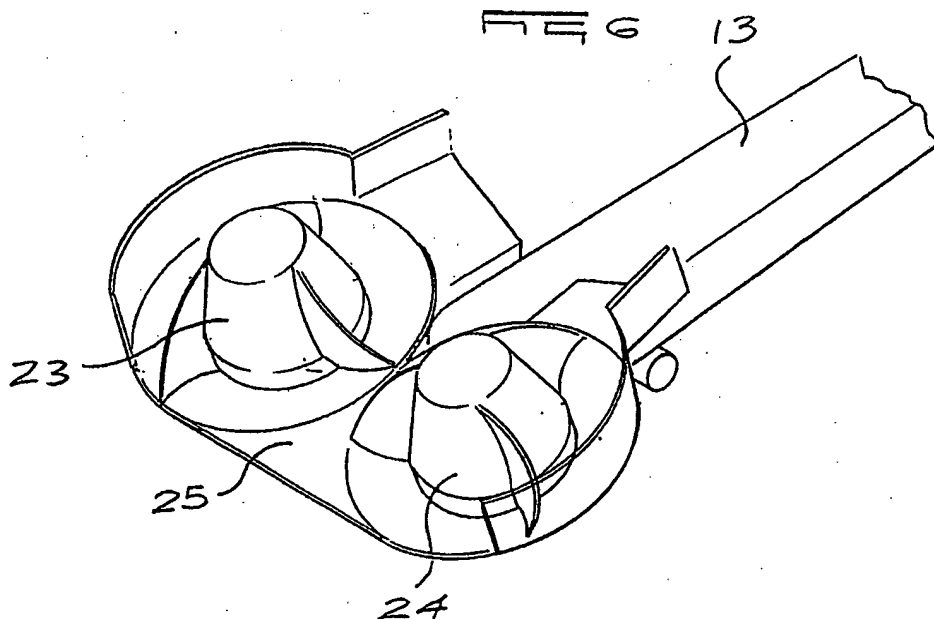


FIG 6



INTERNATIONAL SEARCH REPORT

In **national Application No**
PCT/IB 01/01933

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65G69/18 B65G65/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 11 09 608 B (INSTITUT FÜR FÖRDERTECHNIK LEIPZIG) 22 June 1961 (1961-06-22) the whole document	1,4,5,8, 9,12,17
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X	DE 12 84 900 B (INSTITUT SHELESNODROSHNOGO TRANSPORTA) 5 December 1968 (1968-12-05) the whole document	1,3-5,8, 9,12,17

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the International search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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